Critical Success Factors in Construction Projects (Governmental Projects as a Case Study)

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ABSTRACT

The importance of the construction sector and its Great role in the provision of services and infrastructure, reduce poverty, improve living conditions and improve the economic situation in the country, impose attention to the way in which the projects implemented for its improvement and to get successful projects. The objective of this research was to determine the criteria for success as well as critical success and failure factors that have a significant impact on project success. A selected 75 engineer (department managers, project managers and engineers) are asked to fill the questionnaire form, Sixty-seven valid questionnaire forms were analyzed statistically to get search results, which were as follows : Twelve critical success factors, the most important factors of it were ("contractor financial efficiency ", " security ,political , economic stability ", "the project manager competence" and " Integration and clarity of contract documents ") , thirteen critical failure factors, the most important factors of it were ("corruption " , " external circumstances ", "Financial difficulties of owner)", and ten success criteria , the most important criteria of it were ("within allocated budget" , " within time period" , "Quality").

Key word: critical success factors, critical failure factors, success criteria and project .

عوامل النجاح الحرجة في المشاريع الانشائية (المشاريع الحكومية حالة دراسية)

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الخلاصة

ان اهمية قطاع الانشاءات و دوره الكبير في توفير الخدمات و البنى التحتية ، تقليل الفقر و تحسين الحالة المعيشية و الحالة الاقتصادية في البلد ، تفرض الاهتمام بالطريقة التي تنفذ فيها المشاريع لتحسينها لغرض الحصول على مشاريع ناجحة. كان الهدف من هذا البحث تحديد معايير النجاح اضافة الى عوامل النجاح و الفشل الحرجة التي لها تاثير كبير على نجاح المشروع . لتحقيق اهداف البحث . تم اختيار 75 مهندس (مدير قسم , مدير مشروع و مهندس) لغرض ملئ استمارة الاستبيان . تم استرجاع سبعة و ستون استمارة صالحة تم تحليلها احصائيا للحصول على نتائج البحث ، التي كانت كماياتي : اثنى عشر عامل نجاح حرج اهمها (الكفاءة المالية للمقاول ، الاستقرار السياسي ، الامني و الاقتصادي في البلد ، كفاءة مدير المشروع و تكامل وثائق المقاولة) , ثلاثةعشر من عوامل الفشل الحرجة , اهمها ("الفساد"، "الظروف الخارجية"، "الصعوبات المالية للمالك) اضافة الى عشرة معايير للنجاح، اهمها ("ضمن الميزانية المخصصة "،" ضمن الفترة الزمنية "،" الاستدامة "و" الجودة ") .

الكلمات الرئيسية : عوامل النجاح , عوامل الفشل الحرجة , معايير النجاح و المشروع .

1. INTRODUCTION

The construction sector is one of the most important sectors in any country , it plays a major role in providing buildings , public institutions, infrastructure, reduce poverty, improve the pension status of the citizens, job creation, improve the environment, improve the economic sector and other important matters offered by this sector . Despite the availability of all the possibilities, experiences, factors and other things that lead to the success of construction sector and projects that it offers, but the proportion of the failed projects is relatively large in Iraq , project failure is common in all countries of the world, even developed ones but in varying proportions, This failures proportion requires identification of problems and imbalances suffered by this industry in addition to identification of factors that will raise the success rate of Iraqi construction industry projects, if the project is completed within the agreed budget , on time and according to the desired quality, "the 'golden triangle'", the project considered successful , this is Far from reality. The construction industry participants have to notice the critical success factors, along with 'golden triangle', to ensure its continuity, **Toor and Ogunlana, 2009**. The work of the companies in the construction sector is project-oriented, i.e., it is unique and has a known start and finish, Zwikael**, 2012**. The difficulties and the obstacles facing the departments of organizations in this sector could be minimizing the negative effects through the use of tools and construction project management techniques. The proper usage of the project management tools in all phases of the project, will ensures the smooth execution of project activities. Generally research is divided into two parts, the first part is theoretical part and the second side is the practical side, the theoretical part reviews projects and project management, failure and success of the construction projects in addition to the critical factors for success and failure and success criteria in the construction sector , The practical side In it, will identify critical factors and criteria for success through case studies and direct meetings with specialists in the field of construction in addition to the closed and open questionnaire and also extract a mathematical model to calculate the the project success index .

2. PROJECT AND PROJECT MANAGEMENT

The project definition must be general to include examples of the organizational activities wide variety of which the managers consider to be "the project functions." and, it should be narrow enough It is allows distinguish it from other projects , describe as "project-oriented." There are many definitions for the project, including:

1- The project is a human and nonhuman resources combination Integrates together in a temporary organization for the purposes of achieve a specified objective, **Kerzner ,2001** .

2- The project is a temporary endeavor undertaken to meet a unique objectives and goals within a defined time frame, budget and scope, **PMI, 2008**.

3- The project is a succession of complex, unique, and connected activities having a goal or purpose must be completed according to specification, within budget, and by a specific time.

The project management can defined as, " the techniques, skills, tools, and knowledge application to the project activities in order to meet the project requirements , **PMI, 2008** and **turner ,1996**, defined the project management " the competencies of different individuals and grouping them together to facilitate access to achieve the project objectives and ensure the project success". The project life cycle, is a logical sequence of the activities to fulfillment the project's goals, consist of five phases namely; (the *Project Initiation*, the *Project Planning*, the *Project Execution*, the *Monitoring and Controlling* stage, and the *Project Closure)* phases .The attention to details, proper documentation at each stage and the

involvement of the key stakeholders ensures the success of the project. For example, the setting of the scope and specifications of the project in the Initiation phase enables the project manager and sponsor to be clear with the purpose, budget, expected outcomes, time frame and deliverables of the project. And also, the experience shows that getting the things right at the Planning phase is very critical for project success and the project outcomes sustainability. The Planning phase ties into the project Execution phase during which there should be a constant Monitoring and Controlling of all of the project aspects. The good monitoring, control and evaluation of the projects during its execution enhance the project success rate. The project's success is achieved by the integration of the role of all parties in all phases of the project from the idea stage to the operating and Maintenance stage.

3. PROJECT SUCCESS

Success can be defined as "the degree to which the project objectives and expectations are met" It always viewed from different perspectives. Indeed, the measuring of the project success is a complex task since the success is intangible and hardly be agreed upon. In the project management literature the project success concept had not been well-defined properly. **Shenhar and Wideman, 2000**, Indicated that there is no integrated understanding on the idea of success in either the business or project management literature. **DeWit, 1988**, distinguished between the project success, which measured against the overall goals of the project, and the project management success which measured against the traditional and widespread measures of performance against quality, time and cost. There are still too many examples of projects exceeding their budgets, running late, or failing to meet other objectives. it is very important, before any discussion of the factors leading to a successful project, to describe exactly what is a "successful, in its simplest terms, the project success can be thought of as the incorporating of four basic facets, if it :

1- Comes in on-budget (monetary criterion).

2- Comes in on-schedule (time criterion).

3- Is used and accepted by the clients and users for whom the project was intended (Client satisfaction criterion).

4- Achieves basically all the objectives originally set for it (effectiveness criterion). **Baccarini, 1999**, introduced five maxims to measure project success regardless of the project duration, size or scope which are; delivering of the product according to the customer needs; delivering the quality that consistent with the price; delivering the project within the agreed timeframe; delivering of the desired that the customer wishes; existing a system of conflict resolution that is fair to the development team and the customer. The project usually targeted for use by the client, either external or internal to the organization, its reasonable; therefore, that any project implementation success assessment should include these five metrics.

3.1 Critical Success Factors

The certain factors that are more critical to the project success than others , are called "critical success factors (CSFs)". term "critical success factors," in the projects and the management of projects, was used firstly by **Rockart ,1981** , defined as " those factors predicting success on projects ".the critical success factors are a group of project areas or variables that are correlated to the project success strongly, and whose maximization or minimization, will lead to project success. According to **Russell and Jaselskis, 1992**, the critical success factors are a limited number of variables in which the satisfactory results will ensure the successful competitive performance of the organization, department, or individual. And they are the few important areas where things must go right for the business to be

flourishing. If the results in these areas are not good, then the organization's efforts will be less than desired. **Pinto and Slevin, 1987 ,** found a project model of ten CSFs they are: training, scheduling, communications, feedbacks and reports, user reception, user consultant, technical tasks, personnel (requirement, employment), senior manager support, fault detection and Project mission. **Frese and Sauter,2003,** conclude that generally, the (Schedule Control, Communications, good accountability, , Good Planning , Project leadership and Governance, and Clear Responsibility) are key areas of successful projects. Which means that, the commitment and support from stakeholders, the clear project plan, and a plan for risk management are the critical success factors for project management .**Mbugua et al., 1999** and **Chan and Chan, 2004**, identified five primary CSFs they are " project management actions, external environment, project-related factors, human-related factors and project procedures ". **Abraham, 2003**, identified seven CSFs they are " political environment, employee/organizational enhancement, competitive strategy, economic environment, process benchmarking, market analysis and technical application ". In 2004 Nguyen et al. identified five CSFs among twenty factors of the projects success: (Access to resources, providing adequate financial resources, competent project manager, Commitment to the project and competent project team).

3.2 Success Criteria

Criterion can be defined as "the principle or standard by which something can be judged or decided", Moreover, the success criteria should be measureable and observable. There is a clear difference between success criteria and success factors, the success criteria are measures in comparison with it the project success or failure can be judge; while the success factors can be defined as " those entered to the management systems result in directly or indirectly project success, time, quality and cost "The Iron Triangle" perceived as the major criteria to evaluate the success and performance of construction projects for a long time. Because of the great development of knowledge and the change in the projects and project management, these criteria is no longer sufficient to measure the success of the project, as in the project success literature, the project success criteria also hardly agreed upon in literature. **Lim and Mohamed, 1999**, modeled the project success measurement into a 'micro viewpoint: completion quality, completion safety, completion time, completion performance, completion cost; and the macro-viewpoints: completion operation, completion satisfaction, completion utility, completion time. **Patanakul and Milosevic, 2009,** grouped the success criteria into three: (i) organizational perspective criteria: organizational learning and resource productivity (ii) project perspective criteria: time-to-market and customer satisfaction and (iii) personal perspective criteria: personal growth and personal satisfaction. **Sadeh et al.,2000** , measure the project success from four dimensions:

1) The meeting of design goals,
2) The benefits to the user,
3) The developing organization benefit, and
4) The technological infrastructure benefit **Shenhar et al., 1997**, suggested four distinct dimensions for project success measure: the project efficiency; preparing for the future; business and direct success .Project consists of the integration efforts of a number of various parties, each of these parties has its own criteria for the success of the project as follows :

1-Owner's criteria for measuring success: function for intended use (satisfy the users and customers); on budget; on schedule; quality (workmanship, products); end result as envisioned; return on investment (responsiveness to the audiences); aesthetically pleasing;

minimize aggravation in producing a building and building must be marketable (image and financial).

2-Designer's criteria for measuring success: quality architectural product; satisfied client (develop the potential to obtain repeated work); professional staff fulfillment (learn new skills, gain experience); met design fee and profit goal; met the project schedule and budget; marketable product/ process; easy to operate, constructible design; no "ghosts," liability, claims; socially accepted; well defined scope of work; and client pays (reliability).

3-Contractor's criteria for measuring success: profit; under estimated budget (savings obtained for the owner and/or contractor); meet the schedule of (preconstruction, construction, design); no claims (owners, subcontractors); safety; quality specification met or exceeded; good sub-contractor buy out; client satisfaction (personal relationships); and minimal or no surprises during the project executing.

3.3 Critical Failure Factors

The study of the failure factors is very significant because; the prevention is better than remedial actions , and the elimination or reduction of the failure rate and a significant increase in civil engineering projects' successful level will result in provision of good infrastructures ;housing, bridges, roads, dams, railways and other. Contribute to providing employment opportunities for youth and experts. a reduction in waste of materials, human and fund, enhanced the socio-economic and physical development in the country. Project failure may be defined as "the project which did not meet the cost, time, quality and scope goals. Also, the project is a failure when it fails to persuading or meet the customer's requirements and when it cannot get its planned targets. **Chitkara, 2006**, asserted that it is common to see a project failing to achieve its mission, a very few projects get completed within the original costs and in time. According to **Chitkara 2006**, 49% faced a time overrun from 1 to 157 months and out of 351 projects, 56% had cost overrun (totally 20% cost), sometimes projects like Boston's Big Dig go 50, 60, 90, or more than 100 percent over budget. The various causes of delays in Construction projects in Thailand were (unclear and incomplete drawing, deficiencies between consultant and contractor, improper planning of the sub-contractors and lack of sufficient sources.). **Noulmanee, et al., 2004** , found that the (supervision, unforeseen ground conditions, Poor site management, client initiated variations and low speed of decision making) were the five various failure reasons in construction projects of Hong-Kong, , the " factors relate to the designers, site conditions, weather, user changes, increase in quantity, economic conditions and late deliveries" , are the main project delay factor as indicated by **Ayman, 2000**, in addition to the other endless reasons for non-fulfillment of the project goals. The Failures can be by the unforeseen natural calamities like natural disasters, floods and earthquakes. It can also result come from the deliberate attempts made by the manipulators during the feasibility study stage by incorporating inaccurate cost and time estimates with a view of secure business or start a project. These incorrect actions in the feasibility study phase may lead to unrealistic objectives and thus to significant problems during implementation.

4. RESEARCH METHODOLOGY

The success of the project cannot be achieved without identifying the critical success factors, the critical failure factors in addition to the success criteria , Determine the criteria for success is the first element in maximizing the the proportion of the project's success, these criteria are the main goals that the management of organization and project have to ensure the achievement of it , After that , the identifying of the factors that lead to of gain such criteria

and make use of them in raising the the proportion of the project's success and the factors that would prevent the achievement of these criteria to prevent their occurrence or minimize the negative effects on the success of the project .In order to get these criteria and factors and after studying the related literature, it has been extracted a number of factors and criteria and divided into seven groups. a meetings and interviews were held with a number of project managers, engineers and experts in the field of research who have the technical and scientific expertise to find out the reasons, problems, obstacles and other things that lead to the failure of projects in addition to identifying anything that might reduce or remove their adverse effects, and to determine the criteria for success and the factors that lead to getting these criteria. After the completion of this open questionnaire, a closed form questionnaire have been prepared and presented to a number of experts to evaluate, straightened and improve to the final form for submission it to the sample , Questionnaire was divided into two parts, the first is comprised background questions about the respondents and In the second section the experts were asked to rank the success factors groups and success factors in each group , failure factors and criteria according to their importance by a five-point Likert scale where 5: totally agree, 4: partially agree, 3: indifferent, 2: partially disagree and 1: totally disagree, Seventy-five questionnaire were distributed to the sample, sixty seven of them are valid and are in below description of of the members of sample, followed by statistical analysis of the answers by using the (SPSS) program

4.1 Respondents Background: The sample included a number of head of departments, project managers and engineers who have an experience in the area of government construction sector**, Table 1** shows the respondents background.

4.2 Identification of Critical Success and Failure Factors and Success Criteria

4.2.1 Success factors

In the beginning, the respondents have been asked to identify the ten most important factors for the success of the project, then and from the careful study of the previous literature, the ten most important factors from the respondents and the open questionnaire of the CSFs were grouped under eight main categories. These include: (1) Procurement-related Factors; (2) Project Management Factors;(3) Design team-related Factors; (4) Client-related Factors; (5) Contractor-related factors; (6) external Environment-related Factors ; (7) Project Manager-related Factors and (8) Project Manager-related Factors. **Table 2** Reviews the success factors, groups to which they belong, mean and standard deviation.

If the reliability coefficient above 0.7 it is considered acceptable **Nunnally and Bernstein, 1994**, the higher the Cronbach's Alpha the better the reliability of the set of variables. The Cronbach's Alpha of success factors was computed at 0.865, **Table 3.** which indicates a high level of internal consistency. As for the second condition, Kaiser-Meyer-Olkin (KMO) was used to measure sampling adequacy in the use of factor analysis **Sadeh et el., 2000.** The literature recommends that the KMO value should be greater than 0.50 if the sample size is adequate **Child, 1990.** From the above result; the Kaiser-Meyer-Olkin Measure of Sampling Adequacy has a value of more than 0.50 which is 0.575, this means that the sample size is adequate for analysis. **Table 4** shows the KMO analysis.

4.2.2 Failure factors: **Table 5** reviews the failure factors, mean and standard deviation, **Table 6** reviews the failure factors reliability analysis and **Table 7** reviews the failure factors KMO and Barlett's Test.

4.2.3 Success criteria: **Table 8** reviews the failure factors, mean and standard deviation, **Table 9** reviews the failure factors reliability analysis and **Table 10** reviews the failure factors KMO and Barlett's Test.

5. MATHEMATICAL EQUATION

Which can calculate the degree of success of the project, the closer one of the project the largest success, measuring the degree of success of the project can be divided into two main sections, the first section using the effect of each of the factors of success and failure in the design and implementation phases, the second section by using the criteria for success after implementation phase as follows:

5.1 Design and Implementation Phase:

The Mathematical equation consists from the integration of the impact of critical success and failure factors, as in Eq. (1):

$$PSI = \sum \sum (Wcsn * Wcfn)\ cSn * cFn \quad \text{.....(1)}$$

Where:
PSI: project success index.
Sn: CSF_n efficiency. F_n: CFF_n efficiency.
Wcsn: relative weight of CSF_n. Wcfn: relative weight of CFF_n.

5.2 Post Implementation Phase:

At this stage, after the completion of the project work is successful index calculation will based on the efficiency of getting the criteria for success as shown in Eq.(2) :

$$PSI = \sum (WCn * Cn) \quad \text{..... (2)}$$

Where:
Cn: success criteria n efficiency.
WCn: success criteria n relative weight.

6. ANALYSIS OF THE RESULTS

6.1 Success Factors: Critical success factors and its relative weights have been shown in the **Table 11**. The extraction of relative weights of the factors was done by calculating the total sum of the critical factors averages and then divides the average value of each factor on the total to find out relative importance of each factor, and so on for success criteria and critical failure factors.

6.2 Success Criteria: Success criteria and its relative weights have been shown in the **Table 12**.

6.3 Critical Failure Factors: Critical failure factors and its relative weights have been shown in the **Table 13**.

7. CONCLUSIONS

Conclusions could summarize as follows:

1. The construction sector in Iraq suffers from many problems and obvious defect performance and a large part of this weakness is due to poor management performance and

the lack of knowledge of the ethics of the construction project management application and the right to it.

2- Most of the feasibility studies for government projects incorrect or non-existent originally leading to the project or the building does not offer the purpose for which was established.

3- Recent experience of the engineers and designers which will reflect negatively on the performance.

4-Contracting methods characterized by a major corruption cases in terms of high prices and lack of clarity in many of the paragraphs in addition to the fact that designs and contract documents is not integrated which leads to a huge number of parts orders in government projects which will reflect negatively on the administration and the costs of the projects.

5- Contracting is forwarded the basis of the lower cost tender which leads to that we contract with inefficient companies and is a solid which will reflect negatively on the performance.

6- The absence of proper planning for the implementation and funding of projects which leads to hold the government huge sums of money (The project is implemented with funding from more than one government department, leading to obtain a conflict of powers, which reflects negatively on the performance) in addition to the lack of planning for cost operation and future maintenance and requirements, which could lead to get a project cost of implementation and sessile but the cost of maintenance and operation of high.

7- Identifying CSF's is important as it allows firms to focus their efforts on building their capabilities to meet the CSF's, assist in taking proactive measures for successful project management of construction project and The finding will also be useful for effective management for all type of construction projects (With the exception of some specialized projects such as oil projects), thus helping to raise the overall level of productivity in construction industry.

8-Success criteria that have been identified allows manager of departments and their staff to focus on the factors that lead to raise the proportion of access to these standards as well as the exclusion of the factors that impede access to these standards to achieve high success rates for projects.

9- It is not the use of modern principles (or sustainability) in design, but in rare cases leading to great wastage of money in addition to the lack of access to buildings do not fit with the global development of civilization.

10- Weak in the experience of the committees overseeing the projects or restrict their powers, especially the project manager and who has a very big role in the success of the project structural as well as the nature of the Iraqi citizen and employee and all reflect negatively on the performance in construction projects.

11- Non- transparency and corruption. The Sizable financial resources combined with slow progress in strengthening the rule of law in Iraq have led to widespread corruption in both the public and private economic sectors. These corrupt practices are substantially undermining public confidence and support for a still fragile democratic government and diverting the provision of resources to the poor and the most disadvantaged social groups.

8. RECOMMENDATIONS

1- Introduction of modern technology and patterns turnkey construction and modern materials and the development of project management systems and the expansion of the production of basic building materials to labs list Accordingly, as the new plants so as to ensure the need With the actual development of the domestic market in quantity and quality

and to link the import of construction materials policies in terms of quantity and quality and the prices are not inconsistent with the development of domestic production and support plans and the need The actual local market

2- A comprehensive review of the laws currently in place as the General Conditions of Contract for Works of Civil Engineering two sections I and II and other laws suffer from a clear imbalance has a negative marking on the implementation of the projects in all stages

3- Adoption of the scientific basis of correct and accurate and fair in the classification of contractors and their potential financial knowledge and adoption at the assignment, which is reflected positively on the success of large construction projects

4- It is recommended to develop abilities and characteristics of project managers and Engineers through proper and continuous training programs about effective project Manager Abilities and characteristics with focus on the leadership area.

5- It is recommended for colleges and universities to make their curriculums more responsive to the leadership and management needs for modern engineers through education courses during college. Also, it is recommended to develop leading characteristics and abilities by education courses since college or seminars for project managers and engineers.

6- Carry out detailed studies to determine the most appropriate time to measure the factors and see its impact on the success of the project.

7- The legislation of laws which bear the person (project manager, contractor, designer, director, consultant or others) all the legal and financial responsibilities and to reduce the frequency of administrative error committed.

8-Managers and superintendents within organizations should address
Communication needs. Systems for distributing information and data base management should be evaluated with feedback from managerial personnel. This was by far the most consistent attribute of concern between both groups over multiple surveys.

9-Focus on research and development in addition to interest the evolution of a development staff qualitatively because of its positive impact on the success of projects.

9. FUTURE STUDIES

1-Prepare for future research to determine the critical success factors in the Specialized departments of institutions (Such as the Ministry of Oil Projects and the Ministry of Electricity).

2-Identify the critical success factors affecting the success of the construction companies in Iraq.

3- Identify the critical success factors affecting the success of the governmental organization in Iraq.

4-Preparation of studies to see the applicability of the requirements of (the ISO in construction) and sustainability requirements and specifications relating thereto as well as the principles of the (TQM) to see the difficulties facing the application and the benefits that we get it in the success of projects in Iraq.

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Table 1 Respondent's background.

Respondents	Frequency (percentage) %
Gender	
Male	70
Female	30
	100
Type of respondents position	
1. Project Manager	44
2. Architecture	20
3. Engineer	16
5. Consultant	20
Educational attainment	
B.Sc.	73
High diploma	20
M.Sc.	6
Ph.D.	1
Working experience	
6-10 years	33
11-15 years	28
16-20 years	35
Above 20 years	14
Engineering Specialization	
Civil	43
Mechanic	20
Electric	24
Architectural	13

Table 2. Statistical analysis of success factors.

Item	Success factors group	Success factors	Mean	Sd.
1	Project Management Factors	Training the HR. in the skill demanded by project	3.94	0.910
2		Constructability program	3.75	0.774
3		Motivation/ Incentives Formal dispute resolution process	2.01	0.887
4		Risk identification and allocation	2.62	0.790
5		Prior project management experience	3.14	0.785
6		Control of sub-contractors' work	3.56	0.707
7		Implementing an effective quality assurance program	3.56	0.785
8		Implementing an effective safety program	3.18	0.767
9		Developing an appropriate organization structure	2.90	1.134
10		Top management support	4.16	0.833
11		Decision making effectiveness	3.21	1.022
12		Coordination effectiveness	3.16	1.100

Item	Success factors group	Success factors	Mean	Sd.
13	Project Management Factors	Planning effort	2.28	0.767
14		Troubleshooting	3.13	0.833
15		Feedback capabilities	3.16	1.134
16		Control mechanism	3.53	1.255
17		Communication system	3.16	1.165
18		Formal dispute resolution process	3.01	1.118
		Involvement of Stakeholders	3.14	0.950
19	Procurement Related Factors	Project delivery system (e.g. design-bid-build, design build)	3.1	1.177
		Awarding bids to the right project manager/contractor	3.74	1.077
20		Project bidding method (e.g. price based competitive bidding, negotiated bidding, best value bidding)	3.31	0.974
21		Project contract mechanism (e.g. lump sum, unit price, cost plus, etc.)	2.62	0.995
		Comprehensive contract documentation	3.21	0.876
22	Client Related Factors	Client's ability to define roles	3.18	0.775
23		Client's ability to make decision	3.92	1.118
24		Client's ability to brief	3.06	0.974
25		Client's project management	2.28	0.887
26		Client's emphasis of quick construction	2.62	0.785
27		Client's emphasis on high quality of construction	2.67	1.177
28		Client's emphasis on low construction cost	3.56	0.774
29		Owner's risk attitude (willingness to take risk)		0.707
30		Timely decision by owner/ owner's representative	2.90	0.887
31		Owner's clear and precise definition of project scope & Objectives	3.16	1.166
32		Owner's construction sophistication	2.85	0.785
33		Client's confidence in construction team	2.76	0.774
34		Client's knowledge of construction project organization	2.99	1.030
35		Size of client's organization	3.53	1.166
36		Nature of client (privately funded vs. publicly funded)	3.18	0.887
37		Client's experience	3.48	0.950
38		Influence of client/ client's representative	3.05	1.177
39	Design Team-Related Factors	Design team experience	4.05	0.876
40		Project design complexity	2.99	1.177
41		Mistakes/ delays in producing design documents	4.09	0.974

42		Design team's contribution to construction	3.04	1.077
43		Adequacy of plans and specifications	2.85	1.177
44	Contractor-Related Factors	Contractor experience	4.11	0.775
45		Speed of information flow	3.26	1.118
46		Effectiveness of cost control system	3.05	1.165
47		Contractor's cash flow	4.27	0.767
48		Extent (Involvement) of Subcontracting	3.05	1.022
49		Supervision	3.13	0.833
50		Site and work management	3.95	1.100
51	Project Manager Related Factors	Construction control meetings	2.85	0.879
52		Project manager's ability to delegate authority	3.74	1.043
53		Project manager's adaptability to changes in project Plan	3.19	.984
54		Project manager's early & continued involvement in project	3.16	1.043
55		Project manager's commitment to meet quality, cost &time	3.04	.945
56		Coordinating ability and rapport of project manager with owner/ owner representatives Motivating skills of project manager	2.67	.661
57		Coordinating ability and rapport of project manager with contractors/ subcontractors	2.28	.773
58		Organizing skills of project manager	3.56	.637
59		Leadership skills of project manager	3.19	.595
60		Technical capability of project manager	3.56	.550
61		Project Manager's authority to take financial decision, selecting key team members, etc	3.16	042
62		Project Manager's authority to take day-to-day decisions	3.05	.581
63		Project Manager's experience	4.27	.768
64		Project Manager's competence	3.05	.754
65	Business and Work Environment Related Factors	Human Skill availability	3.26	1.060
66		Technology availability	3.13	.550
67		Adequacy of funding	3.08	.945
68		Commitment of all parties to the project	3.01	.984
69		Administrative approvals environment	3.26	1.043
70		Industrial relations environment	3.05	.945
72		Political environment	4.26	.773
73		Social environment	4.90	.803
item	Success factors group	Success factors	mean	Sd.
74	Work Environment Rel	Economic environment	4.16	.661
75		level of technology advanced	2.85	.796

76		Availability of resources	3.7	.515
77	Project related factors	Human skill availability	3.56	.675
78		Clear objectives	2.85	.661
79		Project size	3.04	.614
80		Project location	2.76	.683
81		project complex	2.99	.614
82		Project importance	3.16	.650
83		Clear understanding of project environment	3.19	.803

Table 3. Success factors reliability analysis.

Cronbach′s Alpha	Cronbach′s Alpha Based on Standardized Items	N of Items
.865	.873	83

Table 4. Success factors KMO and Barlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.575
Bartlett′s Test of Sphericity	Approx. Chi-Square	627.107
	Significant	.007

Table 5. Statistical analysis of failure factors.

Item	Failure factors	Mean	SD.
1	Ineffective project planning and control	2.9	0.910
2	underestimation of time and cost	4.04	0.887
3	Poor monitoring and quality control by regulatory agencies	2.94	0.774
4	Poor design capacity and the frequent design changes	4.44	0.790
5	Lack of available skilled personnel and technical experts	3.29	0.785
6	Vulnerability to and ravaging environmental degradation and devastation due to wrong location.	2.85	0.833
7	Designers and contractors inability to do the work	2.29	0.767
8	Frequent changes and inconsistence in government policy and priority	2.89	0.790
9	Scarcity and lack of original materials requirement	3.06	1.134
10	Prequalification procedure and corrupt government officials.	2.96	1.022
11	Colossal waste of resources in project implementation due to unacceptable design errors and mistakes	3.04	0.833
12	Project contract sum indirectly used to compensate political party big-wigs.	3.28	0.767
13	Youth restiveness, and land ownership disputes	3.19	1.022
14	Litigations and court injunctions	3.15	1.100
15	Inaccessibility and geo hazardous impassable terrain to the	3.09	1.165

	project site		
16	Financial and administrative corruption	3.94	1.255
17	Project scope creep with massive amount of change or variation orders	3.16	0.775
18	Capacity constraints in terms of construction equipment	2.50	0.974
19	Mode of financing and payment for completed work	2.92	1.177
21	Delay in approving major changes in the scope of work by consultant	3.42	1.165
22	Rework due to error by contractor	3.32	1.100
23	Delay due to sub-contractor work	3.24	0.833
24	Inadequate experience of consultant	3.65	0.767
25	Financial difficulties of contractor	4.57	0.785
26	Changes in government regulations and laws	2.21	1.022
27	Delays in producing design documents	3.30	1.100
29	Delaying delivering the site to consultant and contractor	2.67	1.022
30	Financial difficulties of owner (Delays in progress payments by owner)	4.32	1.100
31	Delay in material delivery from the supplier	3.26	1.165
32	Frequent equipment breakdown	2.90	0.833
33	Delay from obtaining sanctions from various authorities	3.30	1.134
34	Inadequate legal framework	2.58	0.785
35	Lack of capable owners Improper planning and Scheduling	2.57	0.790
36	Insufficient data collection and Survey before design	3.24	1.177
37	Obsolete or unsuitable construction methods	3.5	0.807
38	Poor site management and supervision	2.2	1.028
39	Incompetence of project team	4.17	0.967
40	Shortage of manpower (skilled, semi-skilled, unskilled labor)	3.74	0.774
41	Slow payment of completed works	2.5	1.030
42	Bureaucratic administrative system	3.4	0.774
43	Lack of accurate historical information	3.0	1.177
44	Interest and inflation rates	2.94	0.876

Table 6. Failure factors Reliability analysis.

Cronbach′s Alpha	Cronbach′s Alpha Based on Standardized Items	N of Items
.795	.642	44

Table 7. Failure factors KMO and Barlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.743
Bartlett′s Test of Sphericity	Approx. Chi-Square	942.43
	Significant	.054

Table 8. Statistical analysis of Success criteria.

Item	Success criteria	Mean	SD
1	Complete within time period	4.52	.848
2	Sales of the product	2.58	.768
3	Developer-contractor relation	3.5	.754
4	Project safety	4.1	.581
5	Improvement of the management	3.61	1.119
6	Durability	3.5	1.060
7	Complete within allocated budget	4.75	042
8	Developer's reputation	3.4	.550
9	Sustainability	4.42	.754
10	Life cycle cost	3.3	1.119
11	Experience/Knowledge gain from the project	4.14	.637
12	Personnel training	2.58	.595
13	Environmental effect	2.75	.570
14	Company growth	2.57	.654
15	Quality	4.24	.791
16	Capital gain	3.27	.984
17	Project profitability	3.05	1.043
18	Customer's Satisfaction	3.68	.945
19	Customer's confidence on the product of the company	3.53	.803
20	Stakeholders' satisfaction	2.62	.773
21	Project management process	3.19	.661
22	Team creativity	3.04	.946
23	Meeting the regulatory requirements of the new product	2.85	.963
24	Financial	3.56	.945
25	Competency gains	3.77	.850
26	Meeting the market shares	2.85	.930
27	Direct and business success	2.99	.570
28	Impact on the customer	3.43	.637
29	Utility	3.48	042
30	Operation	3.00	1.119
31	technical success	3.95	.581
32	Efficiency	3.26	1.042
33	performance	2.85	.595

Table 9. Success criteria reliability analysis.

Cronbach′s Alpha	Cronbach′s Alpha Based on Standardized Items	No. of Items
.78	.873	33

Table 10. Success criteria KMO and Barlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.651
Bartlett's Test of Sphericity	Approx. Chi-Square	742.31
	Significant	.012

Table 11. Critical success factors and its relative weights.

Item	Critical success factors	Weight%	Group
1	Contractor's cash flow	12.48	Contractor factors
2	Political ,security and economical stable environment	11.89	External environment factors
3	Project manager's experience	10.7	Project manager factors
4	Contractor experience	10.3	Contractor-related
5	Top management support	9.85	Project management factors
Item	Success factors	weight	group
6	Mistakes/ delays in producing design documents	9.3	Design team related factors
7	Site and work management	8.15	Contractor-related Factors
8	Client's ability to make decision	6.32	Client-related Factors.
9	Awarding bids to the right project manager/contractor	6.1	Procurement related factors
10	Design team experience	5.84	Design team related factors
11	Project manager's authority to take day-to-day decisions	4.7	Project manager factors
12	Availability of resources	4.3	External environment factors

Table 12. Success criteria and its relative weights.

Item	Success criteria	Weight%	item	Success criteria	Weight%
1	Complete within allocated budget	14.3	6	Project safety	9.54
2	Complete within time period	13.02	7	technical success	8.75
3	Sustainability	10.85	8	Competency gains	8.34
4	Quality	10.15	9	Customer's Satisfaction	7.85
5	Experience/Knowledge gain from the project	9.74	10	Improvement of the management	7.55

Table 13. Critical failure factors and its relative weights.

Item	Critical failure factors	Weight %
1	Financial difficulties of contractor	``````````
2	Poor design capacity and the frequent design changes	10.1
3	Financial difficulties of owner (delays in progress payments by owner)	8.4
4	Incompetence of project team	8.2
5	underestimation of time and cost	7.75
6	Financial and administrative corruption	6.75
7	Shortage of manpower (skilled, semi-skilled, unskilled labor)	6.45
8	Insufficient data collection and survey before design	6.45
9	Inadequate experience of consultant	5.86
10	Delay in approving major changes in the scope of work by consultant	5.7